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AUTHOR Martin, David S.
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ABSTRACT

Much criticism is being leveled today at the teaching profession, both for failure to provide students with high levels of cognitive functioning, and for failure to apply careful and systematic thinking to the execution of the many demanding instructional tasks required of the teacher's role. A special pilot study tested the effects of a systematic cognitive intervention program on a group of 14 inservice teachers at the Model Secondary School for the Deaf at Gallaudet College (Washington, DC) during a one-year period. The cognitive intervention program used was "Instrumental Enrichment," a special content-free, paper-and-pencil intervention program in which the learner improves problem-solving strategies in 14 cognitive areas, such as comparison, categorization, orientation in space, analytic perception, and logical reasoning. The instructor mediates the learner's work with these materials and provides insight through discussion about the application of these strategies to subject matter and to life situations. When contrasted with a control group of teachers, results indicated that the special program enhanced: use of questioning skills that produced higher cognitive functioning in students; giving of clear and concise directions; provision of instructional alternatives to individual students; diagnosis of student needs; and involvement of students in decision making. It was concluded that inservice training for teachers in improvement of their adult cognitive skills is essential to many of the daily professional tasks of the teachers. (Author/JMK)

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CAN TEACHERS BECOME BETTER THINKERS?

David S. Martin, Ph.D.

Gallaudet College

November 1983

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Running Head: Thinking Skills for Teachers

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Abstract

Much criticism is being leveled today at the teaching profession, both for failure to provide students with high levels of cognitive functioning, and for failure to apply careful and systematic thinking to the execution of the many demanding instructional tasks required of the teacher's role. A special pilot study tested the effects of a systematic cognitive intervention program on a group of in-service teachers during a one-year period. When contrasted with a control group of teachers, results indicated that the special program enhanced: use of questioning skills that produced higher cognitive functioning in students, giving of clear and concise directions, provision of instructional alternatives to individual students, diagnosis of student needs, and involvement of students in decision-making. It was concluded that in-service training for teachers in improvement of their adult cognitive skills is essential to many of the daily professional tasks of the teacher.

Rationale

Much focus is currently being placed on programs in "cognitive education" for students, but relatively little systematic focus has been given to the impact of those skills on the persons with the major responsibility for teaching them, namely, teachers. Because teachers themselves often lack adequate cognitive development from their own schooling, they:

1. are often unprepared to foster such development in their students,
2. are only partially able to identify the cognitive structures underlying curriculum, and
3. fail to apply systematic thinking to their instructional tasks.

For these reasons, it is proposed that a component of teacher in-service education programs be systematic cognitive development through carefully planned adult experiences.

This report presents a brief review of related literature, an analysis of a pilot research study, and a model for incorporating cognitive education as a core component in teacher in-service education programs.

Review of Literature

An identifiable body of research has investigated the methods of enhancing cognitive development in children. Thus, teachers having training in the use of cognitive programs for children would make use of the research that has been done in this area. Notable among these would be the work of Feuerstein (1980), Brown (1978), Henker, et al. (1980), Klein (1981), Loper (1980), Narrol et al. (1978), and Vygotsky (1962).

However, the area of cognitive training for teachers is a separate and less coordinated field of investigation. The works of Orme (1977) and Waksman

et al. (1978) identify some adult cognitive outcomes from training teachers in how to teach cognitive skills to children. Forty-seven percent of a sample of more than 1500 Chicago teachers reported that teaching critical thinking to students was a source of difficulty for them (Radebaugh & Ellis, 1983). However, the case for including cognitive skills training for teachers goes beyond giving them the methodology of teaching those skills to pupils. The case also rests heavily on making teachers into high-level thinkers in the variety of functions which they must fill in their complex roles.

Clark and Yinger (1979) presented a summary of studies of teacher thinking. Taylor (1970) analyzed teacher ability to plan systematically; Zahorik (1975) added to this work; Johnson (1972) focused on teacher judgment in cognitive terms; Mondol (1973) investigated the effects of modifying the situations in which teachers apply alternative strategies in problem-solving; Marland (1982) developed three models of teacher thinking; Duff (1977) found a loose relationship to exist between a teacher's theory and his/her behavior; and works by Gage (1978) and Shulman and Elstein (1975) have called for studying the mental processes of teachers at work.

Herrick (1962) underscored the need for teachers to use critical thinking in identifying important understandings and processes when preparing instructional objectives. Gil (1980) found that teachers did not have specific strategies for gathering information and operated at an incomplete level in pupil diagnosis. The need for the teacher to diagnose cause of student difficulty and to prescribe beyond trial and error was observed by Carbone (1980).

Some evidence exists that the act of teaching itself enhances an individual's cognitive abilities; Murray (1983) reports an experiment indicating that the way that a person organizes his thinking for non-teaching and for teaching are independent and different, and that teachers' proposed strategies for teaching a concept appear to indicate a higher level of reasoning than their own responses to explaining the same concept themselves. The notion, then, of deliberately training teachers to improve their cognitive level appears to be promising for applying that greater sophistication to their teaching if they can also be taught to make a bridge from that training itself to their strategies for teaching. Schenkat and Battaglini (1980) have created a strong case for including reasoning skills in pre-service education, particularly in teaching teachers to operationalize what they are learning about ways to organize instruction for the special-education child; their work makes use of Perry's work on the identification of the nine levels of cognitive behavior which are characteristic of the college-age student (Perry, 1968; Perry, 1981).

An operational definition of specific teaching behaviors as related to cognitive factors has been presented clearly by Costa (1982) using four stages of the teaching act--planning, interaction, analyzing and evaluating, and applying. Within the Planning stage, specific cognitive behaviors include selecting alternative strategies, overcoming the teacher's own egocentrism, classification, and task analysis. In the Interactive stage, cognitive behaviors include use of the strategy, interpreting cues, and making temporal decisions. In the Analyzing and Evaluating stage, the teacher must carry out such behaviors as comparison, and distinguishing cause from effect. Finally,

in the Applying stage, teachers must "project" one classroom experience to the next, and carry out such cognitive behaviors as planning through hypothetical thinking and planning based upon principles using an analysis of previous lessons (Costa, 1982). In regard to the cognitive basis for being a successful classroom manager, Kounin (1970) has identified two skills: "withitness" which is the ability to know what children are doing in the classroom at any moment, and "overlap" which is the ability to pay attention to several ideas or actions at the same time. Buckner & McGrath (1963) have labeled the first of these characteristic skills "vigilance" in regard to being able to monitor ongoing events and to detect changes or deviations in classroom events. Other cognitive psychologists have examined the skill of what has been termed "split attention" in reference to the ability to attend to two or more sources simultaneously (Treisman, 1969; Greenwald, 1972; and Neisser, 1976). Thus, under a variety of labels, the notion of looking at teacher behaviors from a cognitive point of view is indeed not new. However, what must be done at this point is to take a comprehensive approach to the improvement of teacher cognitive behaviors on a global scale; a special kind of intervention program is necessary for such a purpose.

Special Program in Cognitive Education

A special cognitive intervention program (Instrumental Enrichment, Feuerstein, 1980) was selected as the set of strategies to be tested in a special study with in-service teachers because it was already well tested in the education of adolescent and adult populations, and because it appears to be the most comprehensive of the currently available cognitive education programs.

Instrumental Enrichment is a special content-free paper-and-pencil intervention program in which the learner improves problem-solving strategies in fourteen cognitive areas, such as comparison, categorization, orientation in space, analytic perception, and logical reasoning. The instructor mediates the learner's work with these materials and provides insight through discussion about the application of these strategies to subject matter and to life situations. Prior work with the program has demonstrated its success in improving cognitive functioning in adolescents and adults in a variety of educational settings in the United States and elsewhere.

A pilot investigation was carried out during 1982-83 on the impact of this program on an in-service teacher population.

In-Service Education Study

Design

Fourteen teachers at the Model Secondary School for the Deaf at Gallaudet College were identified as the experimental group for training in cognitive education. Twenty-three teachers who were not in the training group were also assessed as a control group. Each experimental subject was a member of a six-day training course in Instrumental Enrichment during a seven-month period in 1982-83. The overt purpose of the training was to teach the content and methodology of this instructional program so that these teachers would be qualified to teach cognitive skills to pupils; however, throughout the training these teachers were given multiple opportunities to discuss ways in which these cognitive skills could be applied to general teacher classroom behavior and to adult life.

Three separate measures were used with both experimental and control subjects to analyze the effect of this cognitive training on teaching behaviors: the Uncritical Inference Test (Haney, 1967), a specially-developed Teacher Self-Rating Scale, and the supervisory evaluation form that is used regularly by program supervisors at the School.

1. The Uncritical Inference Test was administered to experimental subjects at the beginning of the training in the Fall of 1982, and again at the end of the training in May of 1983; the same measures were given to the control group in May only.

2. The Teacher Self-Rating Scale was developed by the author to include items related to planning and systematic approach to solving problems which are involved in the daily work of teaching, and is included as Appendix A. It was administered to experimental subjects in September and May, and to control subjects in May only.

3. The supervisors' rating form was used by regular subject department supervisors on two occasions (September and May) to assess teaching behaviors of experimental and control subjects. This instrument lists twelve different categories of behaviors followed by specific "Indicators" within each category, and is included as Appendix B. From the multiple indicators, the following were selected as most highly relevant to the goals of the cognitive improvement program, and would therefore be the most likely indicators of teaching behavior change for teachers whose own cognitive functioning had been modified through the systematic training:

Area	Item No.	Indicator
Communication	(1 d)	Considering students' comments and suggestions
	(2 c)	Giving directions in clear, concise manner

Prescribing	(4 c)	Making instructional decisions based on evaluation information
	(6 e)	Accepting and using student feedback in planning instruction
Facilitating	(9 e)	Using strategies which involve students in high level of thinking
	(9 f)	Using strategies which involve students in decision-making
	(10 e)	Phrasing questions to encourage students to respond appropriately
Evaluation of Students	(12 a)	Identifying the reasons why students have or have not met performance objectives

The general comments by the supervisors were also analyzed for reference to behaviors that were related to the goals of the cognitive skills training for the teachers.

Two related limitations of this study are acknowledged. 1) the experimental group of teachers was self-selected in that they volunteered to have the training; 2) it is possible that any behaviors which experimental subjects were found to have after the training are related to their characteristics as a group of teachers who are interested in self-improvement and may be confounded with any effects of the training itself. The control group was selected randomly, however.

Results and Discussion

1. Scores on the Uncritical Inference Test were tallied for percentage of right answers across all of the three sections of the Test, and pre and post administrations were contrasted.

No statistically significant difference was found between pre and post testing for the experimental group on the Haney measure of inferential thinking and no significant difference was found between the control group and

the experimental group on the post-measure. Apparently the Haney measure of inferential thinking was not sensitive to any effects of the training, and the training probably does not affect that type of highly verbal inference.

2. Scores on the Teacher Self-Rating Scale were computed by assigning a "5" to the "Strongly Agree" response, "4" to "Somewhat Agree," etc. Group means were then computed, and a contrast between pre and post-testing groups was carried out.

Results on the self-reported measure of teaching behaviors (Self-Rating Scale) shows a statistically significant improvement for the experimental group by the time of post-testing, using the Wilcoxon Rank Test ($T=3$; $p<.05$). Some alteration has clearly occurred in the trainees' perceptions of how they organize the task of teaching; the specific items within the scale (see Appendix A) which showed movement of +.8 or more in mean weighted score between pre and post testing were items: #1 (ability to evaluate own effectiveness), #5 (give colleagues ideas about how to improve instruction), #13 (demand high levels of thinking during teaching), #14 (ask challenging questions), and #15 (encourage group discussions). In addition, a rank test for the difference between independent samples was used to contrast the control group and the experimental group on the May post-test; a T score of 2.57 resulted indicating a significant difference ($p<.05$). It would appear, then, that important effects are perceived by teachers in both their application of cognitive skills to their approach to their work (items 1 and 5) and the teaching techniques which they use to stimulate cognitive growth in students (items 13, 14, and 15). It remains for these effects to be tested with larger groups of teachers.

3. Scoring on the Supervisor Form (Appendix B) was carried out by assigning weighted scores to each item; mean frequencies were then computed for each group for each item; mean frequencies for experimental and control groups were then contrasted and analyzed for differences (see Table 1).

Table 1

Comparison of Experimental and Control Teachers in Supervisors' Observed Frequency of Use of Cognitively-Based Teaching Strategies

Strategy	Experimental (N = 14)		Control (N = 23)	
	Pre	Post	Pre	Post
1 (1d) (Use of student suggestions)	50%	64%	74%	65%
2 (2c) (Clear directions)	64%	71%	57%	65%
3 (4c) (Decisions based on evaluation)	21%	21%	17%	17%
4 (6e) (Use of student feedback)	14%	49%	22%	22%
5 (9e) (Involve students in higher thinking)	64%	93%	61%	52%
6 (9f) (Involve students in decision-making)	49%	64%	35%	31%
7 (10e) (Phrasing questions appropriately)	64%	93%	74%	78%
8 (12a) (Evaluation of students)	14%	28%	26%	22%

The analysis of the experimental and control teachers' ratings by supervisors in Table 1 corroborates the above self-reported changes in methodology used by the experimental teachers on their Self-Rating Scales. The changes in the experimental group teachers can be divided into the two categories of: (1) improvement in methods of fostering cognitive growth in students, and (2) application of higher level cognitive processes to the activities of teaching itself. Specifically, we see little or no improvement for the control group teachers on all of the indicators except for the indicators related to the giving of clear and concise directions and the phrasing of questions; in fact, some small decrease in frequency of the indicators is noted for the control group in four of the indicators, as shown in Table 1. By contrast, the experimental group trained in cognitive education showed improvement in seven out of the eight indicators, and no improvement in one (related to making instructional decisions based on evaluation information). In addition, the range of improvement from pre to post assessment of the experimental group teachers is between 7% and 35% as a group. Tests of significance of difference using the rank test for two independent samples shows that the experimental group differed significantly from the control group at the .05 level; the rank test for correlated samples shows that between the pre and post assessment, the experimental group T score was 17.9; for significance, T needed to be ≤ 17; thus, that growth approaches, although does not reach, statistical significance.

In the category of improving the cognitive skills of students, the clear improvement of the experimental group teachers in considering students' comments (Item 1 d) and in phrasing questions to encourage appropriate responses (Item 10 e), corroborates the earlier work of Orme (1977) and

Waksman, et al. (1978) in which teachers trained in Instrumental Enrichment were found to have improved significantly in their use of "probing" questions in classroom discussion situations. The growth in use of strategies involving students in high levels of thinking (Item 9 e) and use of strategies involving students in decision-making (Item 9 f) is related to the methodology of discussion-for-insight which is continuously modeled and practiced throughout the Instrumental Enrichment (I.E.) training of teachers. The awareness of cognitive development itself would also assist teachers in moving students to increasingly higher levels of thinking in the course of any class period or any sequence of lessons. The effectiveness of this training in producing improved cognitive functioning of students has been corroborated by a separate study of cognitive functioning of students, indicating significant growth in systematic problem-solving and abstract thinking (Martin, et al., 1983).

In the second category of applying higher level cognitive strategies to the tasks of teaching in general, the improvement in giving clear directions (Item 2 c) is directly related to the consistent way in which teachers are taught in the I.E. training to emphasize clarity and to give precise and increasingly complex directions. The improvement in provision of alternatives to meet the needs of individual students (Item 6 e) can be related both to the emphasis on problem-solving strategies which the I.E. program contains, as well as to the practice in using multiple sources of information. Finally, the improvement in identifying reasons why students have or have not met objectives (Item 12 a) can be related to the continuous practice in analysis as a skill through the I.E. training.

The general comments of supervisors in regard to observed teachers also further illuminate these data (Table 2). While four of the twenty-three

Table 2

Comparison of Post-Observation Cognitive Strategies
Used by Experimental and Control Group Teachers
(Supervisors' Comments)

Control Group (N = 23)	Comment	Frequency	Direction (+ = positive, - = negative)
	Students involved in active discussion	1	+
	You gave good feedback to your students	1	+
	Students seem to be able to explain the problem-solving process	1	+
	You use good questioning skills	1	+
	Students are not paying attention to each other in discussion	2	-
	You need more skill in getting synthesis during discussion	1	-
	Students lack persistence in problem-solving	1	-
	You need to develop multiple strategies in teaching	1	-
Total number of teachers receiving comments, positive or negative: 10			
Experimental Group (N = 14)			
	You are asking persistent questions	1	+
	You are making connections between classwork and its applications	3	+
	You are encouraging students to think problems through	1	+
	Students are making relationships during discussions	1	+
	You are asking good thinking questions	5	+
	You are giving clear explanations	2	+
	Students are being asked to defend their answers	2	+
	Students are being moved to higher levels of thinking	2	+
	Students are being helped to talk and think about their own thinking processes	2	+
	You are guiding students instead of telling them	1	+
	You are encouraging students to share their opinions	1	+
Number of teachers receiving comments: 10 (all positive; none negative)			

teachers in the control group received positive supervisor comments directly related to their application of cognitive skills, six were given specifically negative comments in the same regard. On the other hand, ten of the fourteen experimental group teachers were given positive comments in that regard, and none were given negative comments. The types of positive comments given to the experimental group also directly corroborate the goals of I.E. and the above-reported frequency data. The specific comments provide explanatory insight into the meaning of many of the trends in the Teacher Self-Rating Scale results. The frequency of these comments is also an indication of consistency in the effects of the I.E. training for this group of teachers.

Conclusion

The inclusion of cognitive training as a core component in teacher education programs is therefore essential. However, re-training of in-service teachers is equally essential. This cognitive re-education will not be simple or quick, but is founded on the critical need for the following cognitively-based outcomes in teacher behavior:

1. Better selection of curricular foci for the classroom.
2. Improved analysis of curriculum prepared outside the classroom, for classroom use.
3. Improved balance in the selection of instructional techniques.
4. Better diagnostic awareness of cognitive problems of students.
5. Appropriate preparation for the teaching of cognitive development programs to pupils.
6. More precise analysis of instructional problems.
7. Consistent conscious application by the teacher of systematic problem-solving strategies to all aspects of his or her teaching life, including curriculum, instruction, evaluation, community relationships, and diagnosis of student needs.

Systematic cognitive education and re-education of teachers holds the promise of ensuring these behaviors. And, let us remember that the cognitively better developed professional will become not only a better professional, but also a more fully functioning human being in society.

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APPENDIX A

Instrumental Enrichment
Teacher Self-Rating Scale

DIRECTIONS

This checklist is designed to give you the opportunity to assess yourself in regard to certain teaching skills, as part of our project in cognitive education. Below are 15 statements. Read each statement, and make a check in the space below it which best shows how you feel about the sentence. If you agree strongly, check space A; if you agree somewhat, check space B, etc. Fill in only one space for each statement. Thank you very much.

David S. Martin

Strongly Agree	Somewhat Agree	Undecided	Somewhat Disagree	Strongly Disagree

At this time, I believe that I am able to:

1. Evaluate my own effectiveness as a teacher.

A	B	C	D	E

2. Analyze and interpret information from students' records.

A	B	C	D	E

3. Assess my students' social and emotional development.

A	B	C	D	E

4. Assess my students' cognitive development.

A	B	C	D	E

5. Provide specific ideas to my colleagues about how to improve their teaching of hearing impaired students.

A	B	C	D	E

6. Evaluate curricula and materials, and make appropriate decisions about choosing those which are best to use for my teaching purposes.

A	B	C	D	E

	Strongly Agree	Somewhat Agree	Undecided	Somewhat Disagree	Strongly Disagree
7. Team-teach smoothly with other teachers at this school.	A	B	C	D	E
8. Use a wide variety of teaching methods in my daily work.	A	B	C	D	E
9. Be consistently flexible when working with fellow teachers.	A	B	C	D	E
10. Apply critical reasoning skills to my daily work.	A	B	C	D	E
11. Be well organized in my daily work at the school.	A	B	C	D	E
12. Diagnose student needs accurately.	A	B	C	D	E
13. Demand high levels of thinking skills in the way that I teach my subject.	A	B	C	D	E
14. Ask challenging questions when conducting a discussion with my students in class.	A	B	C	D	E
15. Consistently encourage students to participate in group discussions on important topics.	A	B	C	D	E

General Comments about How I View Myself as a Teacher of Thinking Skills:

APPENDIX B

Model Secondary School for the Deaf

OBSERVATION/CONFERENCE FORM

COURSE_____ PERIOD_____ TEACHER_____
DATE_____ PROGRAM SUPERVISOR_____
NUMBER OF STUDENTS_____

AREA: COMMUNICATION

1. The teacher communicates effectively with students by: COMMENTS

   INDICATORS:

   a. signing or spelling most words which are used;

   b. using voice and/or lip movements with signs, as appropriate;

   c. changing vocabulary or method as necessary for comprehension;

   d. listening to and considering students' comments and suggestions.

2. The teacher assures student's comprehension by: COMMENTS

   INDICATORS:

   a. asking students to attend to the speaker;

   b. maintaining eye contact;

   c. giving directions in a clear, concise manner;

   d. making sure each student is using auditory input, as appropriate;

   e. asking students to restate their understanding of a concept in their own words.

3. The teacher encourages student to use clear and concise communication by: COMMENTS

   INDICATORS:

   a. asking students to use English structure, as appropriate;

   b. asking students to use vocabulary from subject matter;

   c. asking students to sign and fingerspell clearly.

AREA: PRESCRIBING

COMMENTS

4. Teacher gathers and interprets data for each student from evaluation instruments, techniques and other professionals by:

INDICATORS:

a. knowing the student's present and potential skill levels;

b. identifying students with special needs (physical, visual, auditory, and manual needs);

c. making instructional decisions based on evaluation information.

5. The teacher utilizes evaluation data and relates these to individual needs by:

COMMENTS

INDICATORS:

a. preparing objectives in terms of student performance;

b. preparing objectives which are measurable;

c. preparing both short and long-term objectives.

6. The teacher plans lessons to meet individual and group needs by:

COMMENTS

INDICATORS:

a. developing lessons consistent with the curriculum;

b. developing lessons that are consistent with the objectives;

c. developing lessons that include appropriate activities which meet individual and group needs;

d. developing appropriate resource materials related to instructional objectives;

e. providing alternatives to meet the needs of individual students;

f. accepting and using student feedback in planning instruction.

AREA: FACILITATING

7. The teacher uses effective classroom management techniques by: COMMENTS

INDICATORS:

a. manipulating the environmental variables that match the instructional method chosen;

b. defining and following up on expectations for student behavior;

c. exhibiting consistency when dealing with behavior problems;

d. keeping students at task most of the time;

e. providing appropriate reinforcement to students;

f. ensuring consistent level of efforts that promotes participation in activities.

8. The teacher presents the subject matter effectively by: COMMENTS

INDICATORS:

a. using words and content appropriate to the subject area and student abilities;

b. using community agencies, groups, and individuals to support the instructional objectives;

c. providing the student with opportunities to develop attitudes, appreciations, and values.

9. The teacher applies learning principles by:

INDICATORS:

a. utilizing and building upon student's interests and prior knowledge;

b. providing feedback as students progress toward goals;

c. utilizing appropriate reinforcers;

d. establishing appropriate practice schedule;

e. using strategies which involve students in high level of thinking;

f. using strategies which involve students in decision-making.

10. The teacher uses a variety of instructional methods by: COMMENTS

INDICATORS:

a. using independent, small group, and total group activities as appropriate to students' needs;

b. using well-designed media and materials to support the instructional objectives;

c. selecting and varying instructional mode that best facilitates student learning;

d. pacing activities within a lesson according to needs of the students;

e. phrasing questions to encourage students to respond appropriately.

AREA: EVALUATION OF STUDENT PERFORMANCE

11. The teacher establishes procedures for evaluating student performance by: COMMENTS

INDICATORS:

a. selecting means of evaluation which are appropriate to the objectives and student needs;

b. planning measurement procedures;

c. recording information based on evaluation procedures.

12. The teacher interprets and utilizes the results of student performance by: COMMENTS

INDICATORS:

a. identifying the reasons why students have or have not met the performance objectives;

b. providing students feedback on their individual performance;

c. reporting progress to the parents;

d. planning changes in teaching strategies based on the results of the assessment.

General Comments by Program Supervisor and Teacher